Docket #71128

DEVICE FOR DISPENSING MEDICAL ACTIVE INGREDIENTS

FIELD OF THE INVENTION

[0001] The present invention pertains to a device and system for dispensing medical active ingredients and more particularly to devices in which the liquid medical active ingredients are fed to the patient at an exactly defined rate.

BACKGROUND OF THE INVENTION

[0002] Injection pumps and perfusors are used for the controlled dispensing of medical active ingredients, which may be, e.g., drugs or anesthetics that enter the patient's bloodstream. Vapors are frequently used in the case of anesthetics that enter the patients respiration circulation, the so-called inhalation anesthetics. In the case of perfusors, the liquid medical active ingredients are pushed forward by the piston of a syringe at an exactly defined rate. The rates of delivery are approximately 0.5 m*L* to 20 m*L* per hour. While no mixtures, but at most an individual anesthetic

is administered in the case of anesthetics, the dispensing of 10 or more different drugs for one patient is not a rarity. Additional drugs are sometimes also added during a therapy. Every individual drug is diluted differently with a carrier liquid, e.g., a Ringer's solution. In light of technical defects, the pressure and the output of the pump is usually monitored. Based on the compliance of the tubes, errors caused by other factors, e.g., reduced rates of dispensing, which may be caused by stenosis in the patient, are detected only with a certain time delay.

[0003] If the rate of dispensing is changed for a medical active ingredient, the time period until effectiveness appears in the patient cannot be precisely determined because of the compliance of the entire system, because if different drugs are dispensed by means of injection pumps and integrated in a bank of stopcocks, the time period until an individual drug becomes effective is additionally determined by the overall volume flow from all injection pumps between the bank of stopcocks and the patient's bloodstream. The medical active ingredient and the carrier solution are usually drawn up manually in the syringes for the injection pumps and perfusors, labeled and introduced. A rate of dispensing is subsequently set. It is obvious that human error may become a cause for a nonoptimally adapted medication in such a situation.

[0004] The infusion device with central control device and a plurality of infusion apparatus for liquid medical active ingredients, which better meets the safety requirements according to the above explanations, is known from Utility Model No. DE 299 22 736 U1. In the case of the infusion device, each infusion apparatus has an unmistakable code number, which is sent to a control device, which will then send corresponding signals to the infusion apparatus.

Precautions are thus taken against an error in dispensing. However, the problem of accurately determining and changing the rates of dispensing still remains to be solved.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide a device for dispensing a plurality of medical active ingredients, with which the rates of dispensing can be set accurately and changed with rapid action.

[0006] According to the invention, a device is designed as a module with coupling means and a fluid interface. The mechanical coupling means of the module may additionally contain electric and data couplings. Using the coupling means, it is possible to connect a plurality of modules in series. The fluid interfaces of the module may be connected to a supply line to a patient. Individual modules are added or removed as desired, without having to interrupt the supply line or to design it differently. The module comprises a cartridge for accommodating a medical active ingredient. This may be, e.g., a drug to be administered in the liquid form through the patient's bloodstream or an anesthetic. The anesthetic that is considered for use is, in principle, an anesthetic administered by infusion or by inhalation. In the first case, the module has a fluid interface to a supply line that is designed as an infusion line and leads to the patient, and a fluid interface designed differently from the former is necessary in the second case, because the connection to a supply line designed as a respiration tube is established. A fluid interface means in both cases that the interface establishes the connection to a supply line that carries a flowing medium, namely, a fluid, i.e., either a liquid or a gas, in its interior. The module comprises,

furthermore, a delivery means for delivering the medical active ingredient from the cartridge to the fluid interface and finally into the supply line leading to the patient.

[0007] In an advantageous embodiment, the cartridge of the module comprises an upper part, which accommodates the cartridge for the medical active ingredient, the delivery means and the fluid interface, and a lower part, which is designed as a holder for the upper part and comprises the coupling means.

[0008] The delivery means is preferably designed as a micropump. Such a pump has an individual dispensing volume that is approximately between 0.2 μL and 3 μL and a maximum pumping frequency in the range of 30 Hz to 200 Hz. This results in a maximum rate of delivery that is approximately between 0.36 mL and 36 mL per minute. The small individual dispensing volume permits the accurate dispensing of very small quantities of a medical active ingredient, so that it is also possible to administer, e.g., drugs in a more highly concentrated solution.

[0009] In another preferred embodiment of the present invention, the cartridge has a code. Machine-readable information on the medical active ingredient that is contained in the cartridge is thus stored. The information pertains, e.g., to the ingredients, the active ingredient concentrations, the date of manufacture and the expiration date, an identification number as well as the manufacturer. This information is stored, e.g., electronically, magnetically or as a bar code.

[0010] In another advantageous embodiment of the cartridge, the cartridge is designed as

a disposable article that can be detached from the module and disposed of after use. As an alternative, it would be conceivable to have the cartridge refilled by the manufacturer or a pharmacy after its use.

[0011] It may also be advantageous to manufacture the entire module as a disposable article. It is ensured by the single-time use that the module is free from microorganisms, which is especially significant for supply lines that are designed as infusion lines and not as respiration tubes, i.e., lead directly into the patient's bloodstream.

[0012] The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its uses, reference is made to the accompanying drawings and descriptive matter in which a preferred embodiment of the invention is illustrated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The Figure shows a module according to the present invention for dispensing a medical active ingredient.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0014] Referring to the drawings in particular, the Figure shows a module according to

the present invention for dispensing a medical active ingredient, which comprises an upper part 1 and a lower part 2. Only the lower parts 3, 4, 5 of three other modules for dispensing different medical active ingredients are shown. The lower parts have the same design as the lower part 2. The lower part 2 is designed as a holder and is used to accommodate the upper part 1, which has a cartridge 6 with a code 7 as well as a delivery means 8 designed as a micropump. The upper part 1 is plugged onto the lower part 2 vertically downwardly in the direction of the arrow. The lower parts 3, 4, 5 as well as the lower part 2 may be connected in series, and they can be connected via coupling means 9, 10, 11. Each lower part 3, 4, 5 has a coupling means 9, 10, 11 each on its side facing the viewer. On its side facing the viewer, the lower part 2 also has a coupling means 12, which establishes the connection of the series-connected modules to an evaluating and control unit 13. These are coupling means 9, 10, 11, 12, which provide an electric and data coupling, besides the mechanical connection. For example, the information stored on the code 7 is transmitted to the evaluating and control unit 13 and processed there. A receiving element each, which optionally receives the coupling means 9, 10, 11 of the respective adjacent module, is located at the lower part 2 as well as at the lower parts 3, 4, 5 on the side that is not visible to the viewer. The cartridge 6 located in the upper part 1 is used to receive a medical active ingredient to be administered. All medical active ingredients are fed here in the manner of a so-called umbilical cord infusion. A carrier liquid, e.g., Ringer's solution, is sent here from a container 14 to the arm of a patient 17 by means of a conventional pump 15 via a supply line 16. The medical active ingredient reaches the fluid interface 18 and the supply line 16 from the cartridge 6 through the delivery means 8 at a rate of dispensing set in advance. The fluid interface 18 is designed as a hollow needle.

[0015] While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.